

# STUDYING OF SAFETY CLIMATE ASSESSMENT: A CASE STUDY AT STEEL INDUSTRY

**Assistant professor Hassan DARVISH**

Payame Noor University, Tehran, I.R. of IRAN

Email: dr\_darvish@pnu.ac.ir

**Mehdi ROOSTAEI**

Payame Noor University

Email: m946roostaei@yahoo.com

**Saeed AZIZI**

Payame Noor University

Email : saeed7167@gmail.com

## *Abstract:*

*Evolution of safety climate used as a practical means has determined and assessed potential problems relevant to safety issues in an organization and can be used in individuals' performance and work efficiency and decreasing rate of incidents ;as well as; guidance to provide safety organization policy and comparison of safety performance in different organizations. The study wants to determine and prepare safety climate profile and application of its results in improving safety situation. In this study, applied tools presented by Loughborough University are used to evaluate safety climate in one of steel industries and data is collected through questionnaire, group discussions or purposeful interviews and observations, and safety climate score was obtained in 17 scopes. Calculating the score of each safety climate domain and preparing the profile indicated there is the average rate (4.89 2) in the safety climate of the industry.*

*Keywords: safety climate, safety evaluation, safety culture, steel industry, Iran*

## **1. Introduction**

Safety climate is a psychological phenomenon and a subset of safety culture and describes employees' common perception about how to manage safety in a work environment in a certain period. According to priorities likes as production and quality, the perceptions provide an index to prioritize safety in an organization. The study of safety climate has been put up as an important index in health and safety issues of work environments and implementations, and corrective actions from it has considerable effect on increasing employees' work efficiency and successful control on injuries in working environment. Safety culture and safety climate have close meanings.

Although safety climate is a psychological phenomenon and indicates employees' perception of safety situation in a certain period and has accompanied situational and environmental factors, it is temporary and topical is susceptible to change. While culture has resisted changes and involves common values among all members of an organization in every level and deal with formal safety issues of organization (Wiegman, 2002). The nature of culture and safety climate and relation between them can be linked to personality and mood, in the direction, "personality" is more stable and "mood" shows more topical characteristics in personality and is temporal

(Cooper,M.D.,2004).Therefore, safety climate has been a

subset of safety culture and describes employees' common perceptions about how to manage safety in a working environment in a certain period (Wiegman,2002). According to other priorities likes as production and quality, these perceptions provide an index to prioritize in an organization.

In a few years ago, defining the fundamental causes of incidents and defects of systems has passed various stages. In the first stage, they had resulted from technical defects specially in the stages of design , manufacture, and maintenance. In the second stage, called human error, human factor is considered as deviation factor of normal conditions. For example, the incident of nuclear plant in Three Mile Island, in which the main thing was human error due to complexity the system .in the third stage, technical –social period, interaction between human factor and technical factor is raised a fundamental cause of incidents, in which importance of interaction among human , machine, and environment is emphasized. In the fourth stage, called organization period, workers perform their tasks in the form of an organization having a specific culture. The beginning of the period has been Chernobyl nuclear incident in 1986 and then culture and safety climate factors have been put up a part of an organization in reasons affecting on industrial incidents.During the recent years, the use of proactive indices such as safety climate, behavior observation have emphasized on current safety activities , along with reactive indices such as incident and defect of system have been paid attention , and integrating both of them can be helpful to access organizations to adequately safety program effects. So, the study is considered as an important index in health and safety issues of work environment, and implementation and reformation action resulting from it has

effect on increasing employees' work efficiencies and successful control of injuries over work environment (Ferraro,L.,2002).

## 2. Literature Review

The term "safety climate" was firstly used as multi-domain factor having important role in work environment safety by Zohar in1980.(Tsong-Chih,2007) in his study (2003) , interaction between safety climate and safety behavior , as well as, other safety indices such as incidents rate was showed and a theoretical model of safety climate was presented.(Simo S.,2007) in contrast , M.D Cooper and R.A. Phillips have brought the problem in challenge and concluded safety climate changes don't inevitably have effect on safe behavior , and also safe behavior change doesn't follow safety climate change(Cox,S.J.,2000).Other study (2007) investigated role of safety climate and work shift on how to understand injury risk and frequency of injury occurrence and concentrate importantly shift in evaluating safety climate and frequency of work environment injuries (Tsong-Chih,2007). Also, the effect of individual and organizational factors on safety climate in universities and other libraries was examined in a study by (TSUNG-CHIN WU, 2006).

The effects of national culture on safety climate among building workers were examined by (Tauha Hussain Ali,2006) in Pakistan. The result showed national culture has a considerable effect on safe behaviors, in other hand, workers' international behaviors have close relation to responsibility and safety management rate(Nicole et al,2007) Finnish speaking workers' and Swedish speaking workers' safety climate were compared and assessed by Simo Saliminen and Anne Seppala. And despite of the fact, frequency of incident in Swedish speaking workers is 30 percent less than Finnish speaking workers. It did not show a significant

difference in safety performance and safety climate between both worker groups and safety culture as a function of safety climate, safe practices, cannot make noteworthy difference in incident frequency (Amparo et al., 2006).

In 2005, Michael Findely and colleagues evaluated 10 dimensions of safety climate aspects including organization relation, and commitment, commitment of management, the supervisor's role, the personnel's role, the colleague's effect, competence, risky behavior, the obstacles to safe behavior, work permit and the report of incidents and pseudo incidents in nuclear installation. The result indicated that there is a significant difference in safety climate among various work groups. The relation between safety climate and safe behavior in production line employees of one of the metal industries in Arak (in Iran) was investigated by Heidari and his colleagues and it indicated constitutional factors of safety climate don't have obvious correlation with job background, but a significant relation between safe behaviors and employees' age and job background was seen. (Heidari, et al., 2002).

### **3. Research Methodology**

#### **3.1. Research Objectives**

The purpose of the study is to determine safety climate and the profile in a steel industry in Iran and to define safety climate in seven-fold domains (commitment of management, health and safety communication, safety priority, etc). To improve safety climate in the industry, the results must be used.

#### **3.2.Problem Statement**

3.2.1. How is safety climate in commitment of management in the steel industry?

3.2.2. How is safety climate in management of style in the steel industry?

3.2.3. how is safety climate in safety priority in the steel industry?

3.2.4. How is safety climate in safety instructions in the steel industry?

3.2.5. How is safety climate in supportive environment in the steel industry?

3.2.6. How is safety climate in participation in the steel industry?

3.2.7. How is safety climate in individual priority and need for safety conditions in the steel industry?

3.2.8. How is safety climate in work environment condition in the steel industry?

3.2.9. how is safety climate in health and safety communication in the steel industry?

3.2.10. how is safety climate in change management in the steel industry?

3.2.11. how is safety climate in employees' competence in the steel industry?

3.2.12. how is safety climate in safe behavior in the steel industry?

3.2.13. How is safety climate in common values in the steel industry?

3.2.14. How is safety climate in adaptation to system in the steel industry?

3.2.15. How is safety climate in incidents and accidents in the steel industry?

3.2.16. How is safety climate in individual perception of risk in the steel industry?

3.2.17. How is the safety climate in style of management in the steel industry?

3.2.18. How is the safety climate in the safety climate profile in the steel industry?

#### **3.3.The Sample**

The research is hold on one of Iran's steel industry to determine the safety climate and provide profile. Here, the statistical community consists of all employees of the industry.

#### **3.4.Material and Methods**

##### **3.4.1.Measurement**

To measure safety climate in the steel industry, tools called safety climate Measurement Toolkit is used and

presented by Loughborough University (A.I.Glendon,2001). The tool can be utilized to examine safety climate or situation in an organization. For this reason, data is obtained through three distinct and independent sources (questionnaire, face to face interview, and group discussions, purposeful observation) and are used in evaluation.

Employees' attitudes in some safety climate domains have been evaluated by questionnaire including 43 items. They have been designed such that involve many domains affecting on safety climate. They are examined by it , along with their concepts are seen in table1:

**Table 1**

**The domain and instance of safety climate**

domain	Instance	Instance	Domain
<b>Commitment of management</b>	Decisiveness of management as to safety issues .	<b>Individual priority</b>	Belief in safety as the first priority.
	Taking safety issues seriously on behalf of management.		Being aware of safety regulations related to occupation.
	Performing proactive activities and tactics of incidents.		Need of continuous reminding of safety issues.
	Immediately reformation of unsafe conditions.		Belief in safety issues in occupation, importantly.
<b>Communication</b>	Supervisors' interest in observance of safety principles on behalf of employees.	<b>Individual perception of risk</b>	Valuing safety environment at work
	Managers' concern on non-observance of safety instructions.		Belief in the most incidents result from hurrying up individuals
	Since and transparent function of management in issues .		Concern on being injured while of working
	Interactive system of safety information ( through setting posters, safety meetings, etc).		Belief in high probability of incident
<b>Safety priority</b>	Encouraging employees for safe action .	<b>Work environment</b>	Being informed of responsibilities and safety.
	Informing employees of current affairs and matters in company on half of supervisors .		Adequate time to act safely
	Attention to safety information on half of supervisors.		
	Following safety methods and regulations		

<b>Safety regulations and instructions</b>	Reliance on the most incidents result from hurrying individuals	<b>participation</b>	Conflict of work objectives with safety indices.
	Belief in safety issues having high priority		conditions for preventing action
	Giving priority to safety as much as production on behalf of management		access to individual protection devices.
	Belief in safety methods and regulations to perform task		Interference in management of important safety issues
	Health and safety regulation and instructions are whether applicable or unpracticed		Participation in safety issues in work environment
	Ignoring some safety obligations due to the production and lack		Participation in examination of safety issues at work
	Encouraging workers who observe safety principles as compared with others		
<b>Supportive environment</b>	Report of unsafe conditions		
	Valuing safety principles on behalf of workers		
	Belief in effectiveness on health and safety issues.		
	Responsibility toward ignoring safety instructions by individuals		

To measure reliability of questionnaire in a pilot study, 15 questionnaires were completed 2 times and internal homogeneity coefficient was computed by Cronbach Alpha and SPSS software. The questionnaire has been set on 6 Iranian industrial experts to measure content credibility or validity and their reformative views were brought to the questionnaire.

It should be mentioned, it used Liker. The scale ranging from "strongly disagree" to "strongly agree" on five points (5 for strongly agree, 4 for agree, 3 for no idea, 2 for disagree, and 1 for strongly disagree). the quantitative value of items was the same and total score have been obtained and finally the score of each domain was appointed a number between zero and ten. For example, to calculate commitment of

management, the formula is used as follows:

(score of item 9) + (score of item 16-6) + (score of item 19-6) + score of item 26 + score of item 33 + score item 38 + score of item 42) × 1035

### 3.4.2. The Interview

The interview of FDG (Focus group Discussion): the interview was done to investigate 5 domains from safety climate and titles of their concepts correspond to table 2:

The purposeful observations: here, data is resulted from direct and indirect observations:

### 3.4.3. The Observation

#### 3.4.3.1. Indirect observation

In the stage, records of incidents and backgrounds in organization were investigated:

**Table 2**

**The FGD Interview of safety climate domain**

Cooperation	Competence and training	Structure of management	Management of change	Common values
Management in health and safety meetings. Employees' participation in providing safety instructions and activities. Safety reviews on behalf of management. Enthusiasm of management of employees' participation in safety matters. Welcome management for suggestion to health and safety.	Managers' confidence to employees' competence in health and safety. Proportion of health and safety training to occupation. Effectiveness of awareness and skill on work safety issues. Training in health and safety issues.	Transparent policy of management about health and safety. How supervisors talk to their workers. Being a role model of supervisor in observing health and safety. Receiving health and safety information.	Training after changes in work methods. Receiving information as to changes of facilities. The effect of changes on safety facilities on behalf of management.	The employees' beliefs in objectives of the policy on behalf of management. The employees' belief in effort in order to the goals.

### 3.4.3.2. Direct Observation

To examine workers' behavior while of performing their occupational tasks, checklists of safety behavior consideration was utilized. After summing up between 0-10, the data from above method (questionnaire, interviews, observation) will importantly be considered in different domains and will form 17 radii in a uni-focus

circulation, each of them have marked between 0-10. With determining the scores from the industry in each domain and marking it on the axis and then linking the points of all axes, the chart is finally obtained and indicates safety climate profile or safety conditions in the industry. Each of the obtained scores in each domain will be comparable to the score 6 the cut point.

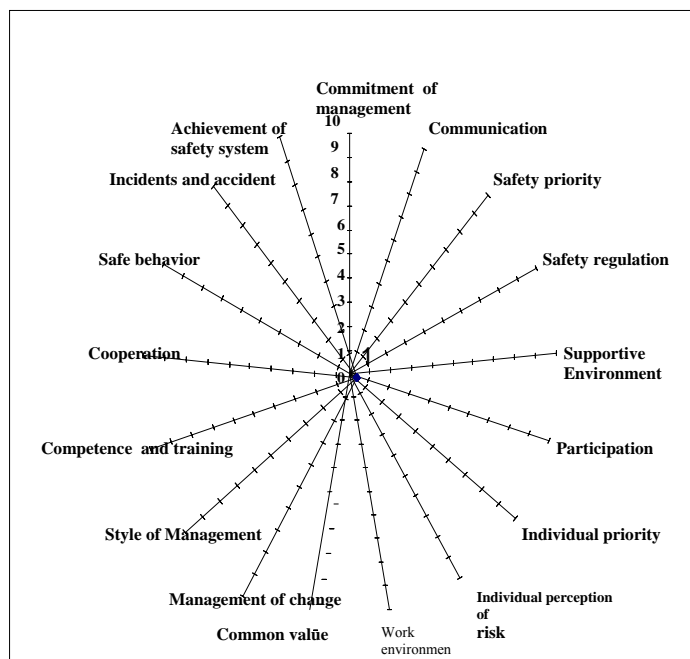


Figure 1. Radar chart of safety climate profile

## 4. Analysis and Presentation of findings

Totally, 85 subjects were asked to complete the questionnaire (all they were working in the location of the study). Their age range and job background were 30-35 years old and

10-24 years, respectively. 98.8 of them were married from an employment situation point of view, 43 subjects were official and 42 subjects were contractual. The results are completely observed in the following table 3:

**Table 3****Descriptive analysis of the sample**

rank	Domain of evaluation	Evaluation method	Mean of scores( standard deviation)
1	Commitment of management	Questionnaire	6/03(1.27)
2	Communication	Questionnaire	5/77(1/19)
3	Safety priority	Questionnaire	6/45(1/45)
4	Safety instructions and regulations	Questionnaire	6/11(1/67)
5	Supportive environment	Questionnaire	7/06(0/9)
6	Participation	Questionnaire	5/85(1/68)
7	Individual priority and lack of safety	Questionnaire	8/54(0/85)
8	Individual perception of risk	Questionnaire	4/94(1/19)
9	Work environment	Questionnaire	5/76(1/16)
10	Common values	F.G.D	2/8
11	Management of change	F.G.D	3/24
12	Style of management	F.G.D	3/42
13	Competence and training	F.G.D	4/63
14	Cooperation	F.G.D	1/33
15	Safe behavior	Direct observation ( checklist of safe behavior)	4/36
16	Incidents and accidents <sup>1</sup>	Indirect observation ( documentation and statistics of incidents	1
17	Achievement of safety system	Indirect observation ( documentation)	5/83



**Table 4****The ANOVA analysis**

Rank	Domain of investigation	Educational level Test of ANOVA		Group based on age Test of ANOVA)		Job background T-Test		Employment situation Test of ANOVA)	
		P-Value	Result	P-Value	Result	P-Value	Result	P-Value	Result
1	Commitment of management	0/74	N.S	0/03	S	0/57	N.S	0/88	N.S
2	Communication	0/39	N.S	0/06	N.S	0/46	N.S	0/87	N.S
3	Safety priority	0/57	N.S	0/15	N.S	0/94	N.S	0/73	N.S
4	Safety instructions and regulations	0/11	N.S	0/06	N.S	0/40	N.S	0/06	N.S
5	supportive environment	0/25	N.S	0/52	N.S	0/38	N.S	0/54	N.S
6	Participation	0/92	N.S	0/06	N.S	0/23	N.S	0/95	N.S
7	Individual priority and lack of safety	0/29	N.S	0/02	S	0/29	N.S	0/50	N.S
8	Perception of risk	0/13	N.S	0/44	N.S	0/78	N.S	0/48	N.S
9	Work environment	0/07	N.S	0/06	N.S	0/07	N.S	0/04	S

S=significant

N.S= non- significant

As seen in above table, variance analysis test (ANOVA) and t-test don't indicate significant relation between education and job background and attitude domains of safety climate . The result from variance analysis test among the groups based on age hasn't statistically shown a significant difference in their attitude toward safety , expect for two domains of management commitment and individual priority and the need for safety. In addition of work environment domain , the results from the variance analysis test (ANOVA) in the grouping on basis of employment situation suggest there is no significant difference between official and contractual workers from attitude domains of safety climate point of view.

## 5. Conclusion and Recommendation for Future Research

According to Likert scale , if cut point is considered as score 6 and a higher boundary ( good and very good) is noted , it can be concluded that 5 of 17effective domains on safety climate of the industry ; individual priority and lack of safety (  $8.54 \pm 0.85$ ) ,supportive environment (  $7.06 \pm 0.09$ ),safety priority ( $6.45 \pm 1.45$ ),safety instructions and regulations( $6.11 \pm 1.67$ ) , commitment of management (  $6.03 \pm 1.27$ ) have an acceptable position. If the score of various domains are considered the same weight, the mean of scores in safety climate will be  $4.89 \pm 2$  in the study and dominant conditions is evaluated average.

With referring to definitions and concepts of the domains, it can be observed that employees and

management believe in safety as the first priority in the organization and they value award of regulations relevant to their occupation. Also, employee suppose to cab be effective on health and safety issues. They have been encouraged to observe safety issues and have sense of responsibility to observe safety instructions.

Although commitment of management domain has been divided in the score 6.03 with boundary limit , the result from interview groups in domains of common values , management of change, and style of management (table 1) showed improvement must be fulfilled in domain of the industry . decisiveness of management as to safety issues, taking safety issues seriously on behalf of management , performing proactive activities as to incidents, immediate reformation of safety problems on behalf of management , supervisors' interest in safety principle on behalf of employees and mangers' and supervisors' concerns on non-observance of safety instruction were criticized by employees.

On the other hand, in rest of 11 domains , namely; domains of individual perception of risk ( $4.96 \pm 1.19$ ), work environment ( $5.76 \pm 1.19$ ), communications( $5.77 \pm 1.19$ ) , participation ( $5.85 \pm 1.68$ ) in questionnaire investigation , domains of cooperation ( $\pm 1.33$ ), common values

(mean = 2.8) management of charge(mean=3.24) , style of management ( mean=3.42), competence and training (mean= 4.63) in interviews and safety behavior domains (mean=4.35) incidents and accidents (mean=1) , and the achievement of safety system ( mean= 5.83) , the situation of the industry is undesirable.

The research showed safety climate is in average in the industry. In some domains of safety climate such as commitment of management , communication, safety priority , safety regulations, supportive environment , participation , individual priority , individual perception of risk , work environment, safety climate achievement are approximately in average. Other domains including common values, management of change, style of management, competence and training, cooperation, safe behavior, incidents and accidents, the obtained score is poor. Thus, planning on these domains is necessarily considered to develop them in the industry. although the safety climate chart ( figure 1) has been evaluated and can be acted proportional to economic , culture and organizational potentials to improve planning safety climate in the dusty.

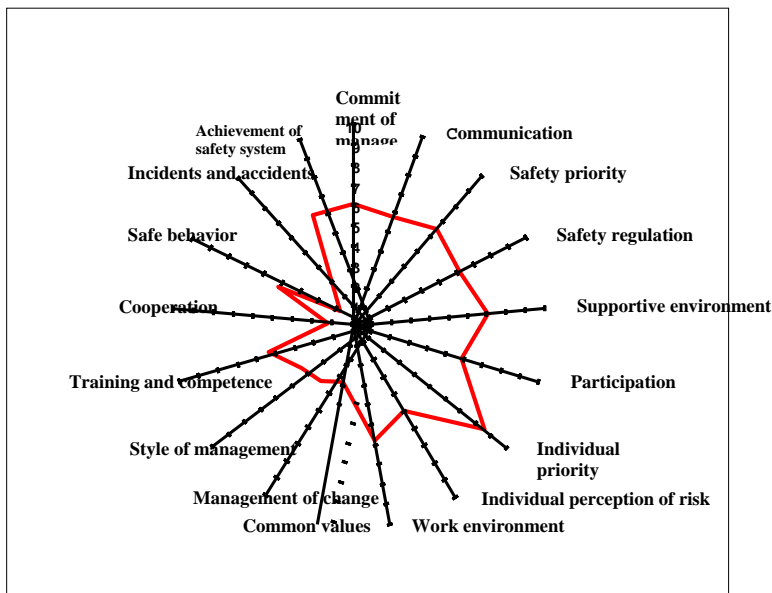


Figure 2. Final radar Chart of safety climate profile in the steel industry

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